DiamondMax 17
80-160GB
Serial ATA

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This class B digital apparatus complies with Canadian Standard ICES-003.
Cet appariel numerique de la classe B es conforme a la NMB-003 du Canada.

TUV Rheinland EN 60 950

Tested to FCC Rules for Radiated and Conducted Emissions, Part 15, Sub Part J, for Class-B Equipment.

DiamondMax 17 80-160GB Serial ATA model number 6GXXXXX drive meets the EU directive for the Restriction and Use of Hazardous Substances (RoHS), 2002/95/EC of the European Parliament and the council of 27 January, 2003.

Korean EMC certifications are issued by Radio Research laboratory (RPL), which is organized under the Ministry of Information and Communications (MIC). EMC testing includes electromagnetic emissions (EMI) and susceptibility (EMS). Certified equipment is labeled with the MIC mark and certification number.

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Before You Begin

Thank you for your interest in Maxtor DiamondMax 17 80-160GB Serial ATA hard disk drives. This manual provides technical information for OEM engineers and systems integrators regarding the installation and use of Maxtor Serial ATA hard drives. Please do not remove or cover up Maxtor factory-installed drive labels. They contain information required should the drive ever need repair. Drive repair should be performed only at an authorized repair center. For repair information, contact the Maxtor Product Support Center at 1-800-2MAXTOR.

CAUTION: Maxtor hard drives are precision products. Failure to follow these precautions and guidelines outlined here may lead to product failure, damage and invalidation of all warranties.

1. ***Before*** unpacking or handling a drive, take all proper electrostatic discharge (ESD) precautions, including personnel and equipment grounding. Stand-alone drives are sensitive to ESD damage.

2. ***Before*** removing drives from their packing material, allow them to reach room temperature.

3. During handling, ***never*** drop, jar, or bump a drive.

4. Once a drive is removed from the Maxtor shipping container, ***immediately*** secure the drive through its mounting holes within a chassis. Otherwise, store the drive on a padded, grounded, antistatic surface. ***Never*** stack hard drives. This may cause damage to the drive.

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Chapter 1
Introduction

This chapter gives an overview of the contents of this manual, including the intended audience, how the manual is organized, terminology, conventions, and references.

1.1 AUDIENCE

The DiamondMax 17 80-160GB Serial ATA hard disk drive product manual is intended for several audiences. These audiences will include: the end user, installers, developers, consumer electronics and personal computer original equipment manufacturers (CE/PC OEM), and distributors. This manual provides information about installation, principles of operation, interface command implementation, service and support.

1.2 MANUAL ORGANIZATION

This manual is organized into the following chapters:

- Chapter 1 – *Introduction*
- Chapter 2 – *General Description*
- Chapter 3 – *Installation*
- Chapter 4 – *Product Specifications*
- Chapter 5 – *ATA Bus Interface and ATA Commands*
- Chapter 6 – *Service and Support*
- Glossary

1.3 TERMINOLOGY AND CONVENTIONS

In the Glossary at the back of this manual, you can find definitions for many of the terms used in this manual. In addition, the following abbreviations are used:

- ASIC Application-Specific Integrated Circuit
- ATA Advanced Technology Attachment
- Bels sound power units
- bpi bits per inch
- DA Double Amplitude (represents pk-pk shaker displacement)
- dB decibels
- dBA decibels, A weighted
- DPS Data Protection System
- ECC Error Correcting Code
- G/rms root means square
- Hz hertz
- kfci thousands of flux changes per inch
- KB kilobytes
- LSB Least Significant Bit
- mA milliamperes
- MB Megabytes (1 MB = 1,000,000 bytes when referring to disk transfer rates or storage capacities and 1,048,576 bytes in all other cases)
- Mb/s Megabits per second
- MB/s Megabytes per second
- MHz Megahertz
- ms milliseconds
- MSB Most Significant Bit
- mV millivolts
- ns nanoseconds
- PC Personal Computer
- SATA Serial ATA Interface
- tpi tracks per inch
- µs microseconds
- V Volts

The typographical and naming conventions used in this manual are listed below. Conventions that are unique to a specific table appear in the notes that follow that table.

Typographical Conventions

- **Names of Bits:** Bit names are presented in initial capitals. An example is the Host Software Reset bit.
- **Commands:** Interface commands are listed in all capitals. An example is WRITE LONG.
- **Register Names:** Registers are given in this manual with initial capitals. An example is the Alternate Status Register.
- **Parameters:** Parameters are given as initial capitals when spelled out, and are given as all capitals when abbreviated. Examples are Prefetch Enable (PE), and Cache Enable (CE).
- **Hexadecimal Notation:** The hexadecimal notation is given in 9-point subscript form. An example is 30_H.
- **Signal Negation:** A signal name that is defined as active low is listed with a minus sign following the signal. An example is RD–.
- **Messages:** A message that is sent from the drive to the host is listed in all capitals. An example is ILLEGAL COMMAND.

Naming Conventions

- **Host:** In general, the system in which the drive resides is referred to as the host.
- **Computer Voice:** This refers to items you type at the computer keyboard. These items are listed in 10-point, all capitals, Courier font. An example is FORMAT C:/S.

1.4 REFERENCES

For additional information about the ATA interface, refer to the latest revision of the draft standard on the internet at http://www.t13.org/ using the link under "1532D AT Attachment-7 with Packet Interface (ATA/ATAPI). For additional information about the Serial ATA interface, refer to the latest specifications on the internet at http://www.serialATA.org using the "specs and design guidelines" link.

Chapter 2
General Description

Serial ATA is a high-speed link replacement for the Parallel ATA attachment of mass storage devices. The serial link employed is a high-speed differential layer that utilizes Gigabit technology and 8b/10b encoding. This chapter will provide you with an overview of key features of the DiamondMax 17 80-160GB Serial ATA hard disk drive, performance data, reliability, and versatility data. Performance and installation data are provided in chapters 3 and 4 respectively.

2.1 PRODUCT OVERVIEW

Maxtor is the one of the industry leader's in developing Serial ATA (SATA) and providing Serial ATA hard drives in volume.

Serial ATA provides faster data transfer speeds, more bandwidth, more potential for speed increases in future generations and better data integrity. Serial ATA hardware is smaller and more compact than traditional Parallel ATA components. A powerful command set and hot plug feature make SATA very attractive for ATA RAID applications.

The latest version of the Serial ATA interface used in the DiamondMax 17 doubles the original maximum (burst) data transfer speed of 1.5Gb per second to 300MB per second. This increase maximizes drive throughput for future growth in drive transfer rates supporting data intensive environments.

The DiamondMax 17 Serial ATA hard disk drive features an embedded hard disk drive controller, and uses ATA commands to optimize system performance. Because the drive manages media defects and error recovery internally, these operations are fully transparent to the user.

The innovative design of the DiamondMax 17 Serial ATA hard disk drive incorporates leading edge technologies with transfer speeds up to 300MB/second, Advanced Cache Management, Shock Protection System (SPS), Data Protection System (DPS), Quiet Drive Technology (QDT), and Fly Height Adjust Technology. These enhanced technologies enable Maxtor to produce a family of high-performance, high-reliability drives.

2.1 KEY FEATURES

The DiamondMax 17 Serial ATA hard disk drive includes the following key features:

General

- Low profile, 1-inch height
- Emulation of IBM® PC AT® task file register, and all AT fixed disk commands
- Windows NT2000, XP, Server, and Media Center Edition certification
- Thin cables for easy routing and improved cooling
- 1 meter cable length for increased design and layout flexibility
- Connectors designed for blind mate and hot plug
- Reduced pin count to enable RAID scalability
- Point-to-Point host to device connection
- Low voltages
- Interface power control features
- Easy installation/configuration (plug/play,no jumpers, no external terminators)
- Command optimization
- Native Command Queuing using First Party DMA

Performance

- Average typical seek time of <12 ms for 80GB, <8.9 ms for 160GB
- 300MB/sec interface data transfer rate
- Average rotational latency of 4.17 ms
- Serial ATA interface with transfer speeds up to 300MB per second
- 8MB Cache buffer
- Look-ahead DisCache feature with continuous prefetch and WriteCache write-buffering capabilities
- AutoTask Register update, Multi-block AutoRead, and Multi-block AutoWrite features in a custom ASIC
- Read-on-arrival firmware
- Quadruple-burst ECC, and double burst ECC on-the-fly
- 1:1 interleave on read/write operations
- Adaptive cache segmentation
- FDB (Fluid Dynamic Bearing) Motors
- Fly Height Adjust Technology

Reliability

- 550k hours mean time expected until failure (MTTF)
- Automatic retry on read errors
- S.M.A.R.T. 4 (Self-Monitoring, Analysis and Reporting Technology)
- Transparent media defect mapping
- High performance, in-line defective sector skipping
- Reassignment of defective sectors discovered in the field, without reformatting
- Data Protection System to verify drive integrity
- Quiet Drive Technology

2.1 REGULATORY COMPLIANCE STANDARDS

Maxtor Corporation's disk drive products meet all domestic and international product safety regulatory compliance requirements. Maxtor's disk drive products conform to the following specifically marked Product Safety Standards:

- Underwriters Laboratories (UL) Standard 1950. This certificate is a category certification pertaining to all 3.5-inch series drives models.
- Canadian Standards Association (CSA) Standard C.22.2 No. 1950. This certificate is a category certification pertaining to all 3.5-inch series drives.
- TUV Rheinland Standard EN60 950. This certificate is a category certification pertaining to all 3.5-inch series drives models.
- Korean EMC certifications are issued by Radio Research laboratory (RPL), which is organized under the Ministry of Information and Communications (MIC). EMC testing includes electromagnetic emissions (EMI) and susceptibility (EMS). Certified equipment is labeled with the MIC mark and certification number.

Product EMI/EMS Qualifications

- CE Mark authorization is granted by TUV Rheinland in compliance with our qualifying under EN 55022:1994 and EN 50082-1:1997.
- C-Tick Mark is an Australian authorization marked noted on Maxtor's disk drive products. The mark proves conformity to the regulatory compliance document AS/NZS 3548: 1995 and BS EN 55022: 1995.
- Maxtor's disk drives are designed as a separate subassembly that conforms to the FCC Rules for Radiated and Conducted emissions, Part 15 Subpart J; Class B when installed in a given computer system.
- Approval from Taiwan BSMI. Number: D33019

2.1 HARDWARE REQUIREMENTS

The DiamondMax 17 Serial ATA hard disk drive is compatible with the IBM PC AT, and other computers that are compatible with the IBM PC AT. It connects to the PC either by means of a third-party SATA adapter board, or by plugging a cable from the drive directly into a PC motherboard that supplies a SATA interface.

Chapter 3
Installation

This chapter explains how to unpack, configure, mount, and connect the Maxtor DiamondMax 17 80-160GB Serial ATA hard disk drive prior to operation. It also explains how to start up, format, and operate the drive.

3.1 SPACE REQUIREMENTS

Figure 3-1 shows the external dimensions of the DiamondMax 17 80-160GB Serial ATA hard disk drive. For more information, please refer to Chapter 4 for detailed product specifications.

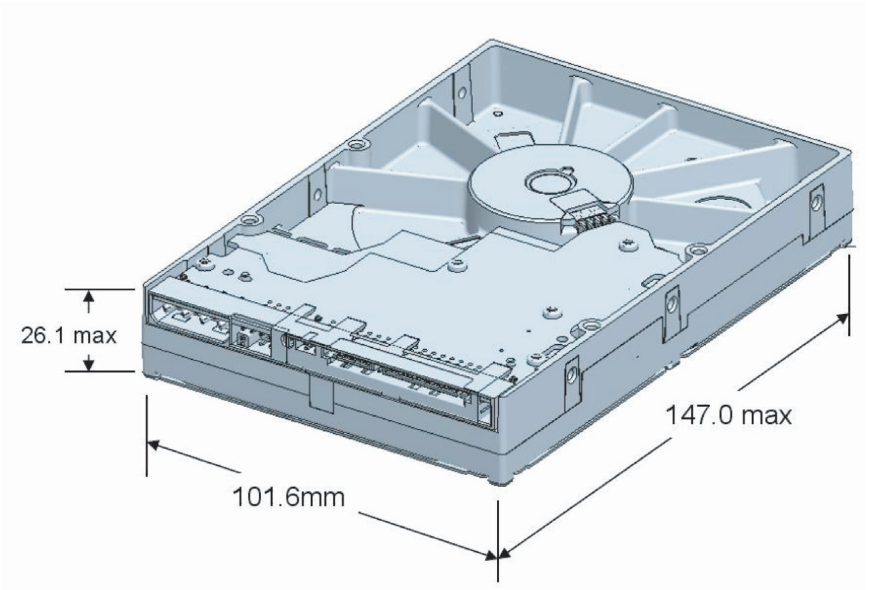


Figure 3-1 Mechanical Dimensions

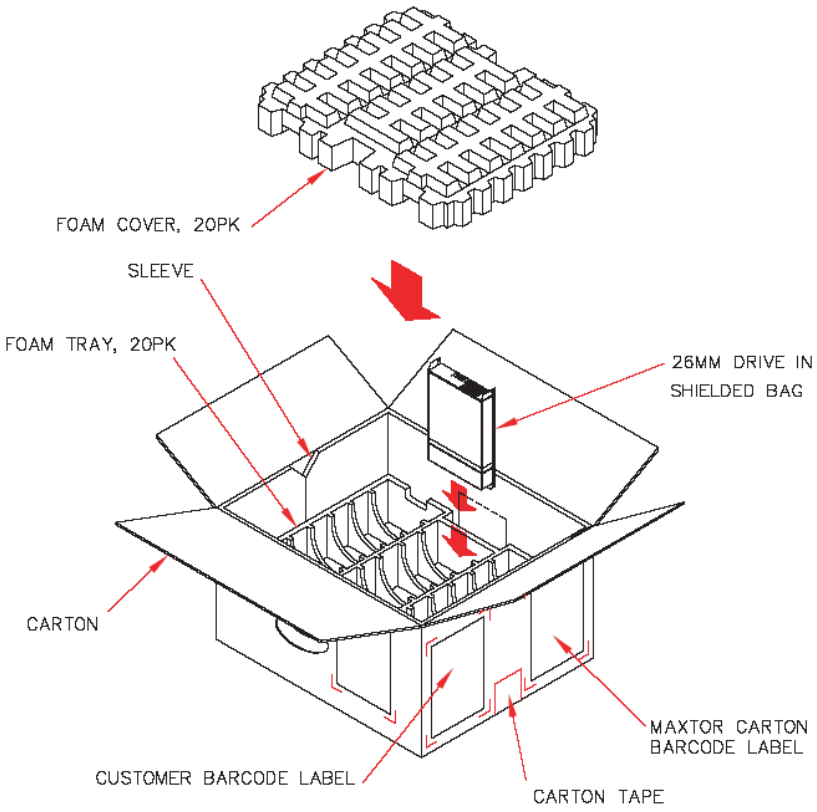
3.2 UNPACKING INSTRUCTIONS

CAUTION: The maximum limits for physical shock can be exceeded if the drive is not handled properly. Special care should be taken not to bump or drop the drive. It is highly recommended that the DiamondMax 17 80-160GB Serial ATA hard drives are not stacked or placed on any hard surface after they are unpacked. Such handling could and will cause media damage.

CAUTION: During shipment and handling, the antistatic electrostatic discharge (ESD) bag prevents electronic component damage due to electrostatic discharge. To avoid accidental damage to the drive, do not use a sharp instrument to open the ESD bag and do not touch Printed Circuit Board components. Save the packing materials for possible future use.

1. Grounded wrist straps should be worn when opening the ESD bag.
2. Three layer runners should be installed on every table and bench where the product is processed while still vulnerable to ESD.
3. Open the shipping container and remove the packing assembly that contains the drive.
4. Remove the drive from the packing assembly.
5. Always handle the disk drive from the sides.
6. Do not touch the circuit board.
7. Never stack the disk drives on top of one another nor store them on their sides.
8. When you are ready to install the drive, remove it from the ESD bag.

Figure 3-2 20-Pack Shipping Container



3.3 HARDWARE OPTIONS

3.3.1 Serial ATA Interface Connector

The Maxtor DiamondMax 17 80-160GB Serial ATA hard disk drive ships with 2 no connect (NC) pins for the purpose of storing a jumper when not in use. For normal operations, no action is necessary. However, if your motherboard does not support the Gen. II (3Gbps) data rate, you will need to limit the data transfer rate by transferring the jumper to the pins as shown in Figure 3-3.

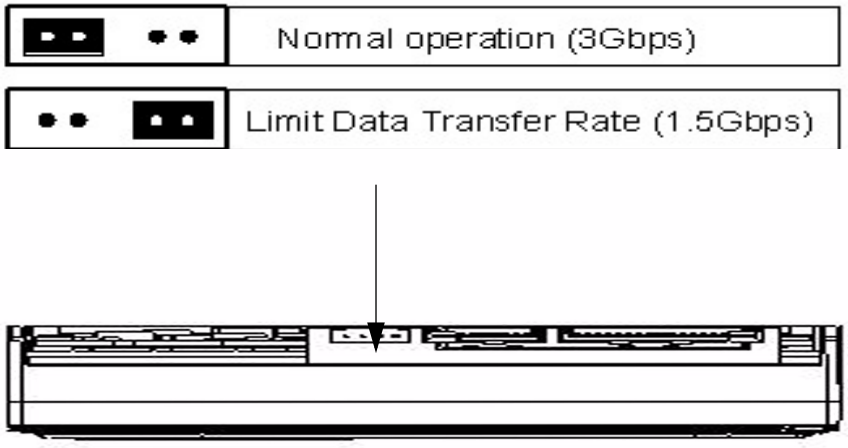


Figure 3-3 Data Transfer Rate Jumper Pin Options

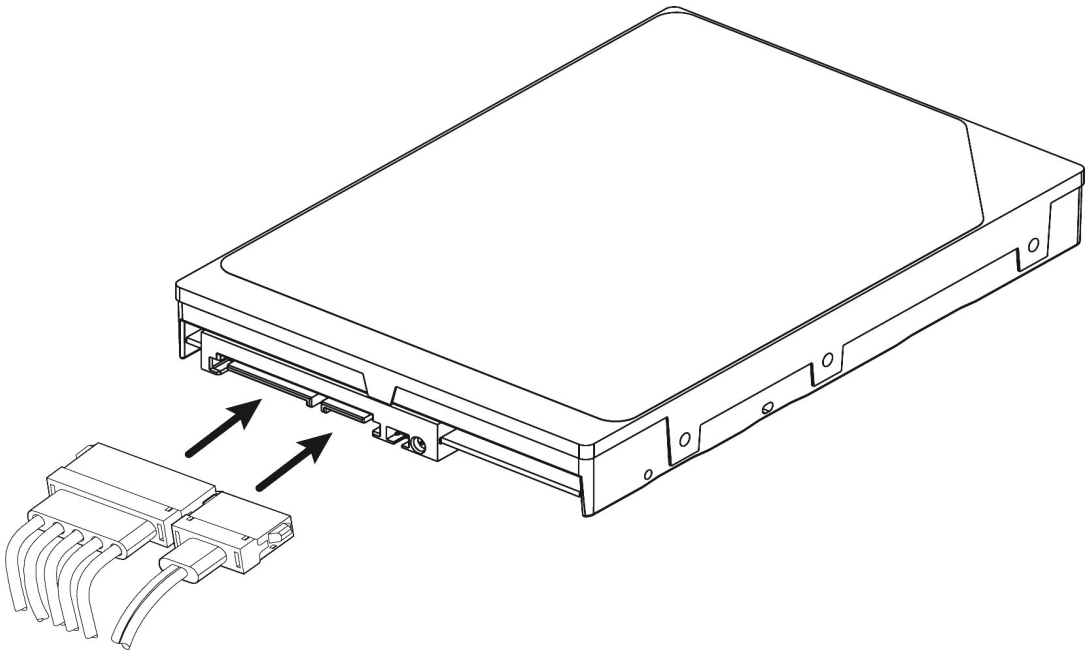


Figure 3-4 The Serial ATA Interface Connector

Note: -5V will be disconnected from connector by the removal of R223 (0 ohm) on the PCBA.

3.3.2 Serial ATA Bus Connector

Some PC motherboards have a built in Serial ATA connector. These Serial ATA connectors are compatible with DiamondMax 17 80-160GB Serial ATA hard disk drives. If the motherboard has a Serial ATA connector, simply connect a 7 pin Serial ATA cable between the drive and the motherboard. See figure 3-5

3.3.3 Adapter Board

If you do not have a built-in Serial ATA interface connector, you must install a Serial ATA adapter board and connecting cable to allow the drive to interface with your system. Maxtor does not supply such an adapter board, but they are available from several third-party vendors.

Please carefully read the instruction manual that comes with your adapter board to ensure signal compatibility between the adapter board and the drive. Also, make sure that the adapter board jumper settings are appropriate.

There are total of 7 pins in the signal segment and 15 pins in the power segment. The pin definitions are shown in the following table (Table 3-1). Note that the pin is numbered from the pin furthest from the power segment.

Table 3-1 Device Plug Connector Pin Definition

Signal Segment Key			
Signal Segment	S1	Ground	2nd Mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd Mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd Mate
Signal Segment "L"			
Central Connector Polarizer			
Power Segment "L"			
Power Segment	P1		Open
	P2		Open
	P3		Open
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V_5	5V power, pre-charge, 2nd mate
	P8	V_5	5V power
	P9	V_5	5V power
	P10	Ground	2nd mate
	P11	Staggered Spin/LED	1. Pin 11, before PHY initialization, is used to detect staggered spin up. If Pin 11 is grounded Drives spin up on power. If Pin 11 is no-connect, the drive will not spin up until host initiates the PHY initialization routine. 2. Pin 11, after PHY initialization, is used for driving LED Activity. The device provides a low voltage-current driver to drive the LED activity signal.
	P12	Ground	1st mate
	P13	V_{12}	12V power, pre-charge, 2nd mate
	P14	V_{12}	12V power
	P15	V_{12}	12V power
Power Segment Key			

The following points should be noted

All pins are in a single row, with a 1.27 mm (.050") pitch.

- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are: (1) the ground pins P4 and P12; (2) the pre-charge power pins and the other ground pins; and (3) the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for precharge in the backplane blind-mate situation.
- If a device uses 5.0 V, then all V_5 pins must be terminated. Otherwise, it is optional to terminate any of the V_5 pins.
- If a device uses 12.0 V, then all V_{12} pins must be terminated. Otherwise, it is optional to terminate any of the V_{12} pins.

3.4 ATA BUS INTERFACE CONNECTOR (J1, SECTION C)

On DiamondMax 17 80-160GB Serial ATA hard disk drives, the Serial ATA bus interface cable connector (J1, section C) is a standard 7-pin Serial ATA. See Figure 3-4.

To prevent the possibility of incorrect installation, the connector has been keyed. This ensures that a connector cannot be installed upside down.

3.5 MOUNTING

Drive mounting orientation, clearance, and ventilation requirements are described in the following subsections.

3.5.1 Orientation

The mounting holes on the DiamondMax 17 80-160GB Serial ATA hard disk drives allow the drive to be mounted in any orientation. Figure 3-5 shows the location of the three mounting holes on each side of the drive. The drive can also be mounted using the four mounting hole locations on the PCB side of the drive.

Note: It is highly recommended that the drive is hard mounted on to the chassis of the system being used for general operation, as well as for test purposes. Failure to hard mount the drive can result in erroneous errors during testing.

Note: Drives can be mounted in any orientation. Normal position is with the PCB facing down. All dimensions are in millimeters. For mounting, #6-32 UNC screws are recommended.

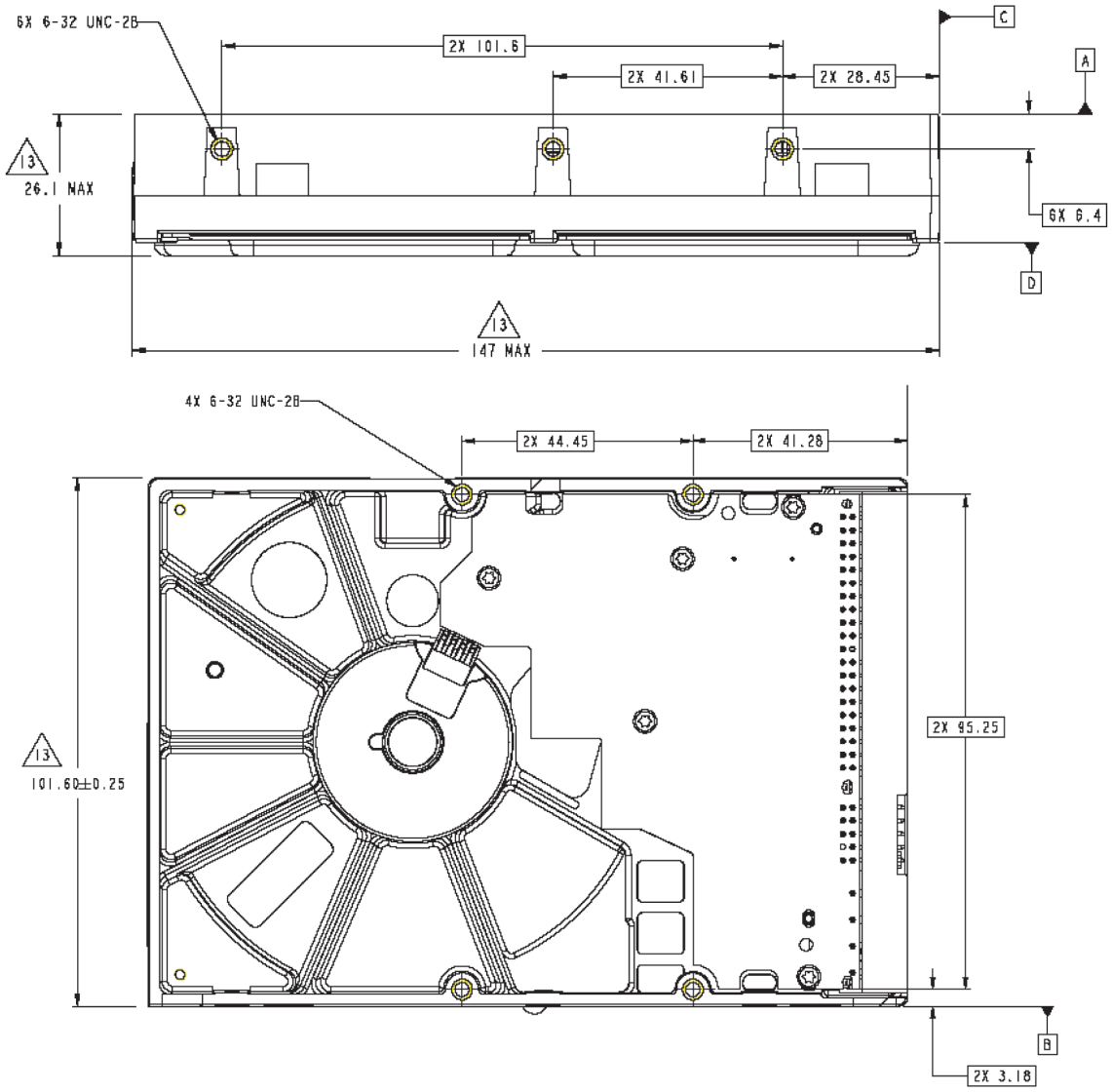


Figure 3-5 Mounting Dimensions and Screw Hole Locations

CAUTION: The PCB is very close to the mounting holes. Do not exceed the specified length for the mounting screws. The specified screw length allows full use of the mounting hole threads, while avoiding damaging or placing unwanted stress on the PCB. The DiamondMax 17 80-160GB Serial ATA specifies the minimum clearance between the PCB and the screws in the mounting holes. To avoid stripping the mounting hole threads, the maximum torque applied to the screws must not exceed 8 inch-pounds. **A maximum screw length of 0.25 inches may be used.**

3.5.2 Clearance

Clearance from the drive to any other surface (except mounting surfaces) must be a minimum of 1.25 mm (0.05 inches). See Figure 3-5.

3.5.3 Ventilation

The DiamondMax 17 80-160GB Serial ATA hard disk drives operate without a cooling fan, provided the base casting temperature as measured where the motor is attached to the base does not exceed 131°F (60°C). Drive reliability and warranty will be limited if the drive is exposed to temperatures greater than 60°C when operating and/or temperatures greater than 70°C when in storage/not operating.

Figures 3-6 and 3-7 show airflow recommended for adequate cooling. Clearance from the drive to any surface above and below the drive must be a minimum of 1.25mm. Maxtor leaves the design and application of cooling and clearance for the disk drive to the user, but the drive must maintain a case temperature at or below 60°C.

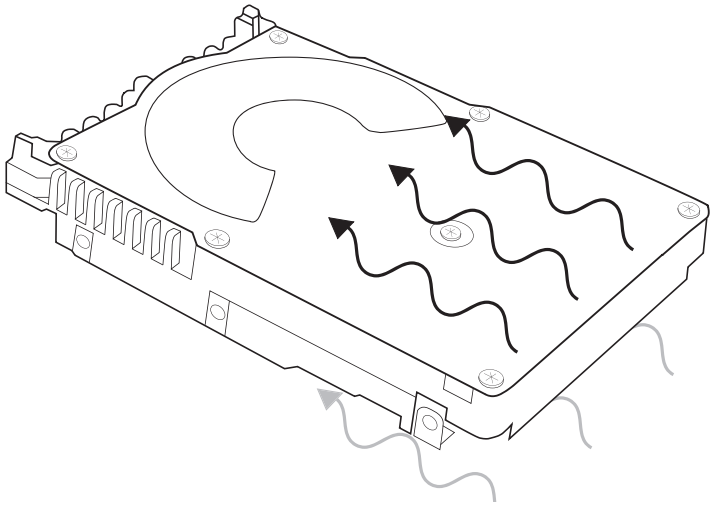


Figure 3-6 Lengthwise Airflow Cooling

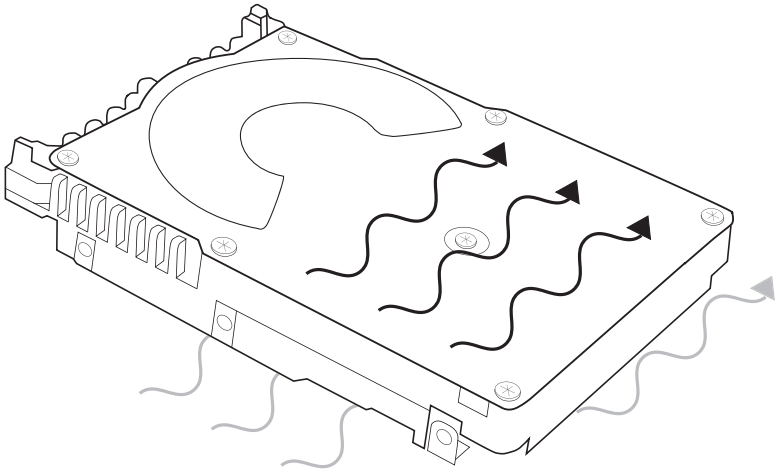


Figure 3-7 Crosswise Airflow Cooling

3.6 FOR SYSTEMS WITH AN ATA ADAPTER BOARD

To install the DiamondMax 17 80-160GB Serial ATA hard disk drive in an AT-compatible system without a Serial ATA connector, you need a third-party IDE-compatible adapter board.

To connect the DiamondMax 17 80-160GB Serial ATA drives, use the Serial ATA cable, 1 meter long or shorter. The Serial ATA cable connectors are keyed to ensure proper orientation.

3.6.1 Adapter Board Installation

Carefully read the manual that accompanies your adapter board before installing it. Make sure that all the jumpers are set properly and that there are no address or signal conflicts. You must also investigate to see if your AT-compatible system contains a combination floppy and hard disk controller board. If it does, you must disable the hard disk drive controller functions on that controller board before proceeding.

Once you have disabled the hard disk drive controller functions on the floppy/hard drive controller, install the adapter board. Again, make sure that you have set all jumper straps on the adapter board to avoid addressing and signal conflicts.

3.7 TECHNIQUES IN DRIVE CONFIGURATION

3.7.1 Operating System Limitations

Most popular operating systems available today have additional limitations which affect the use of large capacity drives. However, these limitations can not be corrected on the BIOS and it is up to the operating system manufacturers to release improved versions to address these problems.

DOS and Windows 95 use a File Allocation Table (FAT) size of 16 bits which will only support partitions up to 2.1GB. Windows 95 OSR2, Windows 98, and Windows ME use a FAT size of 32 bits, allowing partitions of up to 2.2 terrabytes. Windows NT, 2000, and XP use NTFS, which allows partition sizes up to 16 terrabytes.

3.8 SYSTEM STARTUP AND OPERATION

Once you have installed the DiamondMax 17 80-160GB Serial ATA hard disk drive, and adapter board (if required) in the host system, you are ready to partition and format the drive for operation. To set up the drive correctly, follow these steps:

1. Power on the system.
2. Run the SETUP program. This is generally on a Diagnostics or Utilities disk, or within the system's BIOS. Some system BIOS have an auto-detecting feature making SETUP unnecessary.
3. Enter the appropriate parameters.

The SETUP program allows you to enter the types of optional hardware installed—such as the hard disk drive type, the floppy disk drive capacity, and the display adapter type. The system's BIOS uses this information to initialize the system when the power is switched on. For instructions on how to use the SETUP program, refer to the system manual for your PC.

During the AT system CMOS setup, you must enter the drive type for the DiamondMax 17 80-160GB Serial ATA hard drive. The drive supports the translation of its physical drive geometry parameters such as cylinders, heads, and sectors per track to a logical addressing mode. The drive can work with different BIOS drive-type tables of the various host systems.

You can choose any drive type that does not exceed the capacity of the drive. Table 3-2 gives the logical parameters that provide the maximum capacity on the DiamondMax 17 80-160GB Serial ATA hard disk drives.

3.8.1 Big Drive Enabler (software download)

Maxtor's Big Drive Enabler is a one step executable that enables support for drives larger than 137 Gigabytes in Windows 2000 Service Pack 3 and XP Service Pack 1. This utility takes the guess work out of editing the windows registry. The Big Drive Enabler fixes an operating system limitations. This utility is needed anytime a hard drive larger than 137GB is connected to a system's ATA bus, regardless of any system BIOS that supports 48-bit LBA.

Note: Failure to install the required service packs and install the Enabler Big LBA patch can result in data loss when accessing the hard disk beyond 137GB. Refer to Maxtor Knowledge Base Answer ID 960 and Microsoft Knowledge Base Article 303013 for information about Windows limitations and the 137GB barrier.

3.8.2 To use the Maxtor Big Drive Enabler

Download big_drive_enabler.exe from the Maxtor.com website, then double click on the downloaded file to begin installation.

3.9 LOGICAL ADDRESSING FORMAT SPECIFICATIONS

Table 3-2 Logical Addressing Format

Model	Interface	CYL	HD	SPT	Max LBA	Capacity
6G080E0	SATA 300 8MB Buffer	16,383	16	63	156,301,488	80GB
6G160E0	SATA 300 8MB Buffer	16,383	16	63	312,581,808	160GB

Note: Capacity may be restricted to 8.4GB (or less) due to system BIOS limitations. Check with your system manufacturer to determine if your BIOS supports LBA Mode for hard drives greater than 8.4GB. Default logical cylinders is limited to 16,383 as per the ATA-4 specifications.To match the logical specifications of the drive to the drive type of a particular BIOS, consult the system's drive-type table. This table specifies the number of cylinders, heads, and sectors for a particular drive type.

Boot the system using the operating system installation disk then follow the installation instructions in the operating system manual.

Chapter 4
Product Specifications

4.1 MODEL NUMBER AND CAPACITY

Model	6G080E0	6G160E0
Formatted Capacity (GB LBA Mode)	80GB	160GB
GB means 1 billion bytes. Total accessible capacity varies depending on operating environment.		

4.2 DRIVE CONFIGURATION

Model	6G080E0	6G160E0
Sectors per Drive (max LBA)	156,301,488	312,581,808
Integrated SATA 3.0 Gb Interface *Standard Buffer*	8MB	8MB
Recording Method	RLL EEPR4	
Servo Type	Embedded	
Number of Servo Sectors	192	
Data Zones per Surface	16	
Data Sectors per Track (ID / OD)	645 / 1224	
Areal Density (Gbits/in^2 max, ID / OD)	75 / 60.8	
Flux Density (kfci, ID / OD)	430 / 378	
Recording Density (kbpi, ID / OD)	705 / 630	
Track Density (ktpi)	139.7	

4.3 PERFORMANCE SPECIFICATIONS

Model	6G080E0	6G160E0
Seek Times (typical read, ms)		
Track-to-Track	2.5	
Typical Seek	< 12	< 8.9
Full Stroke (normal seek)	23	
Average Latency (ms)	4.18	
Controller Overhead (ms)	< 0.3	
Rotation Speed (RPM ±0.1%)	7,200	
Data Transfer Speed (MB/sec, max)		
To/From Interface	300	
To/From Media (ID / OD up to nn.n, where nn.n is the maximum possible transfer rate)	333 / 619	
Sustained (ID / OD up to nn.n, where nn.n is the maximum transfer rate possible)	30.8 / 58.9	
Drive Ready Time (sec, typical)	< 8.0	

4.4 PHYSICAL DIMENSIONS

Parameter	Value
Height (mm, maximum)	26.1
Width (mm, typical)	101.6 ±0.25
Depth (mm, maximum)	146.1 ±0.25
Weight (g, maximum)	80GB = 455 / 160GB = 460

4.5 POWER REQUIREMENTS – 80GB & 160GB

Mode	Power (Watts)	Current 12V (mA)	Current 5V (mA)
Start-up (peak) over 1 ms	23	1580	775
Seek (peak) over 1 ms*	19.5	1400	530
Sequential Write (average)	7.5	255	850
Sequential Read (average)	7	255	795
Random Seek (average)*	9.5	600	445
Random Read / Write (average)*	8	465	480
Idle Average, no R/W activity	5.5	255	440
Idle Active, low power/head on ramp	4	240	220
Standby (average)	1.3	15	220
Sleep (average)	1.3	15	220
* Acoustic management in performace mode; quiet modes reduce 12V current.			

4.5.1 Voltage Tolerance

Voltage Tolerance
5V ±5%
12V ±10%

4.6 POWER MODE DEFINITIONS

Start-up

The drive is spinning up following initial application of power and has not yet reached full speed.

Seek

A random access operation by the drive.

Read/Write

Data is being read from or written to the drive.

Idle

The drive is spinning, the actuator is parked and powered off and all other circuitry is powered on. The drive is capable of responding to read commands within 40 ms.

Standby

The motor is not spinning. The drive will leave this mode upon receipt of a command that requires disk access. The time-out value for this mode is programmable. The buffer is active to accept write data.

Sleep

This is the lowest power state – with the interface set to inactive. A software or hardware reset is required to return the drive to the Standby state.

4.7 EPA ENERGY STAR COMPLIANCE

Maxtor Corporation supports the goals of the U.S. Environmental Protection Agency's Energy Star program to reduce the electrical power consumption of computer equipment.

4.8 ENVIRONMENTAL LIMITS

Parameter	Operating	Non-Operating/Storage
Temperature	0°C to 60°C (base casting at motor hub)	-40° to 70°C per Mil-STD-810E, method 501.3, climatic category: hot induced conditions.
Thermal Gradient	20°C per hour (maximum)	30°C per hour (maximum)
Relative Humidity	5% to 95% (non-condensing)	
Wet Bulb	37.7°C (maximum)	40°C (maximum)
Altitude (relative to sea level)	-650 to 10,000 feet	-650 to 40,000 feet

Acoustics	**80GB** (1 disk)	**160GB** (1disk)
Idle (typical / maximum): Bels	2.5 / 2.6	2.5 / 2.6
Quiet Seek (typical / maximum): Bels	2.6 / 2.7	2.6 / 2.7
Performance Seek (typical / maximum): Bels	3.1 / 3.3	3.1 / 3.3

Notes:

1. Margin demonstrated implies the product will operate at the stated conditions with an acceptable impact to the ARR specification for any OEM requiring those values in their purchase specification.
2. The testing performed by Maxtor is consistent with ISO 7779. Variation in acoustic levels from the idle specification may occur due to offline activity according to the SMART specification and/or atmospheric conditions.
3. Above 1,000 feet (305 meters), the maximum temperature is derated linearly to 112°F (44°C) at 10,000 feet (3,048 meters).

4.9 SHOCK AND VIBRATION

Parameter	Operating	Non-Operating
Mechanical Shock 1/2 sine	2 ms, R = 0.988 @ 65 Gs	2 ms, R = 0.90 @ ≥ 350G 1 ms, R = 0.95 @ ≥ 200G .5 ms, R = 0.99 @ ≥ 200G
Rotational Linear Vibration 1/2 sine, radians / sec^2	2 ms, 2k	1 ms, 25k
Linear Random Vibration (G rms)	10 – 500 Hz, 0.86	7 – 800 Hz, 3.08

4.10 RELIABILITY SPECIFICATIONS

Annualized Return Rate

< 1%

Annualized Return Rate (ARR) indicates the average against products shipped. ARR includes all reasons for returns (failures, handling, damage, NDF) but does not include inventory credit returns.

Load/Unload Cycles

> 600K

This indicates the average minimum cycles for reliable unload and load of head ramp (where heads are loaded and parked onto a ramp off the disk when not in use).

Data Reliability

< 1 per 10^{15} bits read

Data errors (non-recoverable). Average data error rate allowed with all error recovery features activated.

Component Design Life

5 years (minimum)

Component design life is defined as:

a.) the time period before identified wear-out mechanisms impact the failure rate,

or

b.) the time period up to the wear-out point when useful component life expires.

4.11 EMC/EMI

4.11.1 Radiated Electromagnetic Field Emissions - EMC Compliance

The hard disk drive mechanism is designed as a subassembly for installation into a suitable enclosure and is therefore not subject to Subpart J of Part 15 of FCC Rules (47CFR15) or the Canadian Department of Communications Radio Interference Regulations. Although not required, the disk mechanism has been tested within a suitable end-use product and found to comply with Class B limits of the FCC Rules and Regulations of the Canadian Department of Communications.

The CE Marking indicates conformity with the European Union Low Voltage Directive (73/23/EEC) when the disk mechanism is installed in a typical personal computer. Maxtor recommends that testing and analysis for EMC compliance be performed with the disk mechanism installed within the user's end-use application.

4.11.2 Canadian Emissions Statement

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian department of communications.

Le present appareil numerique n'emet pas de bruit radioelectriques depassant les limites applicables aux appareils numeriques de Class B prescrites dans le reglement sur le brouillage radioelectrique edicte pa le ministere des communications du Canada.

4.12 SAFETY REGULATORY COMPLIANCE

All Maxtor hard drives comply with relevant product safety standards such as CE, CUL, TUV and UL rules and regulations. As delivered, Maxtor hard drives are designed for system integration before they are used.

Chapter 5
SATA Bus Interface and ATA Commands

This chapter describes the interface between the DiamondMax 17 80-160GB Serial ATA hard disk drive and the ATA bus. The commands that are issued from the host to control the drive are listed, as well as the electrical and mechanical characteristics of the interface.

5.1 INTRODUCTION

The Maxtor DiamondMax 17 80-160GB Serial ATA hard disk drive uses the standard ATA/ATAPI-7 interface. Support of various options in the standard are explained in the following sections.

5.2 MECHANICAL INTERFACE

5.2.1 Signal Cable and Connector

The Maxtor DiamondMax 17 80-160GB Serial ATA hard disk drive contains unitized connector for both signal and power connections. The dimensions and specifications of the unitized connector comply with clause 14 in the ATA/ATAPI-7 standard.

5.3 ELECTRICAL INTERFACE

5.3.1 ATA Bus Interface

5.3.1.1 Electrical Characteristics

Signals on the SATA interface are assigned to connector pins according to clause 14 in the ATA/ATAPI-7 standard. The signaling protocol complies with clause 15-17 of the standard.

5.4 REGISTER ADDRESS DECODING

The Maxtor DiamondMax 17 80-160GB Serial ATA hard disk drive allow their host systems to address the full set of command and control registers as specified in clause 5 of the ATA/ATAPI-7 standard.

5.5 COMMAND INTERFACE

5.5.1 General Feature Set

The μProcessor, Disk Controller, and ATA Interface electronics are contained in a proprietary ASIC developed by Maxtor.

5.5.2 Supported Commands

The Maxtor DiamondMax 17 80-160GB Serial ATA hard disk drive supports all the mandatory commands from the general feature set for devices not supporting the Packet command feature set. Table 5-1 lists the supported commands. Refer to the ATA/ATAPI-7 standard for a detailed description of these commands. The IDENTIFY DRIVE command, however, is elaborated in the section "Identify Drive Command" on page 5-5.

Note: 1. As defined in the ATA/ATAPI-7 standard.

Table 5-1 Supported Commands

Command	Command Code	Feature Register Value(s)
CHECK POWER MODE	98h, E5h	
DEVICE CONFIGURATION FREEZE LOCK	B1h	C1h
DEVICE CONFIGURATION IDENTIFY	B1h	C2h
DEVICE CONFIGURATION RESTORE	B1h	C0h
DEVICE CONFIGURATION SET	B1h	C3h
DOWNLOAD MICROCODE	92h	07h, 01h
EXECUTE DRIVE DIAGNOSTIC	90h	
FLUSH CACHE	E7h	
FLUSH CACHE EXTENSION	EAh	
IDENTIFY DEVICE	ECh	
IDLE	97h, E3h	
IDLE IMMEDIATE	95h, E1h	
NOP	00h	
READ BUFFER	E4h	
READ DMA	C8h, C9h	
READ DMA EXTENSION	25h	
READ FPDMA QUEUED	60h	
READ LOG EXTENSION	2fh	
READ MULTIPLE	C4h	

Command	Command Code	Feature Register Value(s)
READ MULTIPLE EXTENSION	29h	
READ NATIVE MAX ADDRESS	F8h	
READ NATIVE MAX ADDRESS EXTENSION	27h	
READ SECTOR(S)	20h, 21h	
READ SECTOR(S) EXTENSION	24h	
READ VERIFY SECTOR(S)	40h, 41h	
READ VERIFY SECTOR(S) EXTENSION	42h	
SECURITY DISABLE PASSWORD	F6h	
SECURITY ERASE PREPARE	F3h	
SECURITY ERASE UNIT	F4h	
SECURITY FREEZE LOCK	F5h	
SECURITY SET PASSWORD	F1h	
SECURITY UNLOCK	F2h	
SEEK	70h	
SET FEATURES	EFh	Note 1
SET MAX ADDRESS	F9h	00h
SET MAX ADDRESS EXTENSION	37h	00h
SET MAX SET PASSWORD	F9h	01h
SET MAX LOCK	F9h	02h
SET MAX UNLOCK	F9h	03h
SET MAX FREEZE LOCK	F9h	04h
SET MULTIPLE MODE	C6h	
SLEEP	99h, E6h	
SMART DISABLE OPERATIONS	B0h	D9h
SMART ENABLE OPERATIONS	B0h	D8h
SMART ENABLE/DISABLE ATTRIBUTE AUTOSAVE	B0h	D2h
SMART EXECUTE OFF-LINE IMMEDIATE	B0h	D4h
SMART READ DATA	B0h	D0h
SMART READ LOG	B0h	D5h
SMART RETURN STATUS	B0h	DAh
SMART SAVE ATTRIBUTE VALUES	B0h	D3h
SMART WRITE LOG	B0h	D6h
STANDBY	96h, E2h	

Command	Command Code	Feature Register Value(s)
STANDBY IMMEDIATE	94h, E0h	
WRITE BUFFER	E8h	
WRITE DMA	CAh, CBh	
WRITE DMA EXTENSION	35h	
WRITE DMA FUA EXTENSION	30h	
WRITE FPDMA QUEUED	61h	
WRITE LOG EXTENSION	3fh	
WRITE MULTIPLE	C5h	
WRITE MULTIPLE EXTENSION	39h	
WRITE MULTIPLE FUA EXTENSION	CEh	
WRITE SECTOR(S)	30h, 31h	
WRITE SECTOR(S) EXTENSION	34h	

5.5.3 Identify Drive Command

This command allows the host to receive parameter information from the drive. When the command is received, the drive:

1. Sets BSY
2. Stores the required parameter information in the sector buffer
3. Sets the DRQ bit
4. Generates an interrupt

The host may then read the information out of the sector buffer. Parameter words in the buffer are shown in Table 5-2.

Note: All reserved bits or words should be zeroes.

Table 5-2 Identify Drive Command Parameters

Word	Content Description
0	General configuration bit-significant information:
	15: 0 = ATA device
	14-8: Retired
	7: 1 = removable media device
	6: Obsolete
	5-3: Retired
	2: Response incomplete
	1: Retired
	0: Reserved
1	Obsolete
2	Specific configuration
3	Obsolete
4-5	Retired
6	Obsolete
7-8	Reserved for assignment by the CompactFlash Association
9	Retired
10-19	Serial number (20 ASCII characters)
20-21	Retired
22	Reserved
23-26	Firmware revision (8 ASCII characters)
27-46	Model number (40 ASCII characters)

Word	Content Description
47	15-8: 80h
	7-0: 00h = Reserved
	01h-FFh: = Maximum number of sectors that shall be transferred per interrupt on READ/ WRITE MULTIPLE commands
48	Reserved
49	Capabilities
	15-14: Reserved for the IDENTIFY PACKET DEVICE command.
	13: 1 = Standby timer values as specified in this standard are supported. 0 = Standby timer values shall be managed by the device
	12: Reserved for the IDENTIFY PACKET DEVICE command.
	11: 1 = IORDY supported. 0 = IORDY may be supported
	10: 1 = IORDY may be disabled
	9: 1 = LBA supported
	8: 1 = DMA supported.
	7-0: Retired
50	Capabilities
	15: Shall be cleared to zero.
	14: Shall be set to one.
	13-2: Reserved.
	1: Obsolete
	0: Shall be set to one to indicate a device specific Standby timer value minimum.
51-52	Obsolete

Word	Content Description
53	15-3: Reserved
	2: 1 = the fields reported in word 88 are valid. 0 = the fields reported in word 88 are not valid
	1: 1 = the fields reported in words (70:64) are valid. 0 = the fields reported in words (70:64) are not valid
	0: Obsolete
54-58	Obsolete
59	15-9: Reserved
	8: 1 = Multiple sector setting is valid
	7-0: xxh = Current setting for number of sectors that shall be transferred per interrupt on R/W Multiple command
60-61	Total number of user addressable sectors
62	Obsolete
63	15-11: Reserved
	10: 1 = Multiword DMA mode 2 is selected. 0 = Multiword DMA mode 2 is not selected
	9: 1 = Multiword DMA mode 1 is selected. 0 = Multiword DMA mode 1 is not selected
	8: 1 = Multiword DMA mode 0 is selected. 0 = Multiword DMA mode 0 is not selected
	7-3: Reserved
	2: 1 = Multiword DMA mode 2 and below are supported
	1: 1 = Multiword DMA mode 1 and below are supported
	0: 1 = Multiword DMA mode 0 is supported
64	15-8: Reserved
	7-0: PIO modes supported
65	Minimum Multiword DMA transfer cycle time per word
	15-0: Cycle time in nanoseconds
66	Manufacturer's recommended Multiword DMA transfer cycle time
	15-0: Cycle time in nanoseconds
67	Minimum PIO transfer cycle time without flow control
	15-0: Cycle time in nanoseconds

Word	Content Description
68	Minimum PIO transfer cycle time with IORDY flow control
	15-0: Cycle time in nanoseconds
69-70	Reserved (for future command overlap and queuing)
71-74	Reserved for IDENTIFY PACKET DEVICE command.
75	Queue depth
	15-5: Reserved
	4-0: Maximum queue depth – 1
76-79	Reserved for Serial ATA
80	Major version number
	0000h or FFFFh = device does not report version
	15: Reserved
	14: Reserved for ATA/ATAPI-14
	13: Reserved for ATA/ATAPI-13
	12: Reserved for ATA/ATAPI-12
	11: Reserved for ATA/ATAPI-11
	10: Reserved for ATA/ATAPI-10
	9: Reserved for ATA/ATAPI-9
	8: Reserved for ATA/ATAPI-8
	7: Reserved for ATA/ATAPI-7
	6: 1 = supports ATA/ATAPI-6
	5: 1 = supports ATA/ATAPI-5
	4: 1 = supports ATA/ATAPI-4
	3: 1 = supports ATA-3
	2: Obsolete
	1: Obsolete
	0: Reserved

Word	Content Description
81	Minor version number
	0000h or FFFFh = device does not report version. 0001h-FFFEh = see 6.16.41 of ATA/ATAPI-7 specification
82	Command set supported.
	15: Obsolete
	14: 1 = NOP command supported
	13: 1 = READ BUFFER command supported
	12: 1 = WRITE BUFFER command supported
	11: Obsolete
	10: 1 = Host Protected Area feature set supported
	9: 1 = DEVICE RESET command supported
	8: 1 = SERVICE interrupt supported
	7: 1 = release interrupt supported
	6: 1 = look-ahead supported
	5: 1 = write cache supported
	4: Shall be cleared to zero to indicate that the PACKET Command feature set is not supported
	3: 1 = mandatory Power Management feature set supported
	2: 1 = Removable Media feature set supported
	1: 1 = Security Mode feature set supported
	0: 1 = SMART feature set supported
83	Command sets supported.
	15: Shall be cleared to zero
	14: Shall be set to on
	13: 1 = FLUSH CACHE EXT command supported
	12: 1 = mandatory FLUSH CACHE command supported
	11: 1 = Device Configuration Overlay feature set supported
	10: 1 = 48-bit Address feature set supported
	9: 1 = Automatic Acoustic Management feature set supported
	8: 1 = SET MAX security extension supported

Word	Content Description	
83	7:	See Address Offset Reserved Area Boot, INCITS TR27:2001
	6:	1 = SET FEATURES subcommand required to spinup after power-up
	5:	1 = Power-Up In Standby feature set supported
	4:	1 = Removable Media Status Notification feature set supported
	3:	1 = Advanced Power Management feature set supported
	2:	1 = CFA feature set supported
	1:	1 = READ/WRITE DMA QUEUED supported
	0:	1 = DOWNLOAD MICROCODE command supported
84	Command set/feature supported extension.	
	15:	Shall be cleared to zero
	14:	Shall be set to one
	13-8:	Reserved
	7:	1 = WRITE DMA QUEUED FUA EXT command supported
	6:	1 = WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands supported
	5:	1 = General Purpose Logging feature set supported
	4:	1 = Streaming feature set supported
	3:	1 = Media Card Pass Through Command feature set supported
	2:	1 = Media serial number supported
	1:	1 = SMART self-test supported
	0:	1 = SMART error logging supported
85	Command set/feature enabled.	
	15:	Obsolete
	14:	1 = NOP command enabled
	13:	1 = READ BUFFER command enabled
	12:	1 = WRITE BUFFER command enabled
	11:	Obsolete
	10:	1 = Host Protected Area feature set enabled
	9:	1 = DEVICE RESET command enabled
	8:	1 = SERVICE interrupt enabled

Word	Content Description
85	7: 1 = release interrupt enabled
	6: 1 = look-ahead enabled
	5: 1 = write cache enabled
	4: Shall be cleared to zero to indicate that the PACKET Command feature set is not supported.
	3: 1 = Power Management feature set enabled
	2: 1 = Removable Media feature set enabled
	1: 1 = Security Mode feature set enabled
	0: 1 = SMART feature set enabled
86	Command set/feature enabled.
	15-14: Reserved
	13: 1 = FLUSH CACHE EXT command supported
	12: 1 = FLUSH CACHE command supported
	11: 1 = Device Configuration Overlay supported
	10: 1 = 48-bit Address features set supported
	9: 1 = Automatic Acoustic Management feature set enabled
	8: 1 = SET MAX security extension enabled by SET MAX SET PASSWORD
	7: See Address Offset Reserved Area Boot, INCITS TR27:2001
	6: 1 = SET FEATURES subcommand required to spin-up after power-up
	5: 1 = Power-Up In Standby feature set enabled
	4: 1 = Removable Media Status Notification feature set enabled
	3: 1 = Advanced Power Management feature set enabled
	2: 1 = CFA feature set enabled
	1: 1 = READ/WRITE DMA QUEUED command supported
	0: 1 = DOWNLOAD MICROCODE command supported
87	Command set/feature default.
	15: Shall be cleared to zero
	14: Shall be set to one
	13-8: Reserved
	7: 1 = WRITE DMA QUEUED FUA EXT command supported

Word	Content Description
87	6: 1 = WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands supported
	5: General Purpose Logging feature set supported
	4: 1 = Valid CONFIGURE STREAM command has been executed
	3: 1 = Media Card Pass Through Command feature set enabled
	2: 1 = Media serial number is valid
	1: 1 = SMART self-test supported
	0: 1 = SMART error logging supported
88	15: Reserved
	14: 1 = Ultra DMA mode 6 is selected. 0 = Ultra DMA mode 6 is not selected
	13: 1 = Ultra DMA mode 5 is selected. 0 = Ultra DMA mode 5 is not selected
	12: 1 = Ultra DMA mode 4 is selected. 0 = Ultra DMA mode 4 is not selected
	11: 1 = Ultra DMA mode 3 is selected. 0 = Ultra DMA mode 3 is not selected
	10: 1 = Ultra DMA mode 2 is selected. 0 = Ultra DMA mode 2 is not selected
	9: 1 = Ultra DMA mode 1 is selected. 0 = Ultra DMA mode 1 is not selected
	8: 1 = Ultra DMA mode 0 is selected. 0 = Ultra DMA mode 0 is not selected
	7: Reserved
	6: 1 = Ultra DMA mode 6 and below are supported
	5: 1 = Ultra DMA mode 5 and below are supported
	4: 1 = Ultra DMA mode 4 and below are supported
	3: 1 = Ultra DMA mode 3 and below are supported
	2: 1 = Ultra DMA mode 2 and below are supported
	1: 1 = Ultra DMA mode 1 and below are supported
	0: 1 = Ultra DMA mode 0 is supported
89	Time required for security erase unit completion
90	Time required for Enhanced security erase completion
91	Current advanced power management value
92	Master Password Revision Code

Word	Content Description
93	Hardware reset result. The contents of bits (12:0) of this word shall change only during the execution of a hardware reset
	15: Shall be cleared to zero.
	14: Shall be set to one.
	13: 1 = device detected CBLID- above ViH. 0 = device detected CBLID- below ViL
	12-8: Device 1 hardware reset result. Device 0 shall clear these bits to zero. Device shall set these bits as follows:
	12: Reserved.
	11: 0 = Device 1 did not assert PDIAG-. 1 = Device 1 asserted PDIAG-.
	10-9: These bits indicate how Device 1 determined the device number:
	00 = Reserved.
	01 = a jumper was used.
	10 = the CSEL signal was used.
	11 = some other method was used or the method is unknown.
	8: Shall be set to one.
	7-0: Device 0 hardware reset result. Device 1 shall clear these bits to zero. Device shall set these bits as follows:
	7: Reserved.
	6: 0 = Device 0 does not respond when Device 1 is selected. 1 = Device 0 responds when Device 1 is selected.
	5: 0 = Device 0 did not detect the assertion of DASP-. 1 = Device 0 detected the assertion of DASP-
	4: 0 = Device 0 did not detect the assertion of PDIAG-. 1 = Device 0 detected the assertion of PDIAG-.
	3:0 = Device 0 failed diagnostics. 1 = Device 0 passed diagnostics.
	2-1: These bits indicate how Device 0 determined the device number:
	00 = Reserved.
	01 = a jumper was used.
	10 = the CSEL signal was used.
	11 = some other method was used or the method is unknown.
	0: Shall be set to one.
94	15-8: Vendor's recommended acoustic management value.
	7-0: Current automatic acoustic management value
95	Stream Minimum Request Size
96	Stream Transfer Time - DMA

Word	Content Description
97	Stream Access Latency - DMA
98-99	Streaming Performance Granularity
100-103	Maximum user LBA for 48-bit Address feature set.
104	Stream Transfer Time – PIO
105	Stream Access Latency – PIO
106	Physical sector size
	15: Shall be cleared to zero
	14: Shall be set to one
	13: 1 = Device has multiple logical sectors per physical sector.
	12-4: Reserved
	3-0: 2^X logical sectors per physical sector
107	Inter-seek delay for ISO-7779 acoustic testing in microseconds
108-126	Reserved
127	Removable Media Status Notification feature set support
	15-2: Reserved
	1-0:
	00 = Removable Media Status Notification feature set not supported
	01 = Removable Media Status Notification feature supported
	10 = Reserved
	11 = Reserved

Word	Content Description
128	Security status
	15-9: Reserved
	8: Security level 0 = High, 1 = Maximum
	7-6: Reserved
	5: 1 = Enhanced security erase supported
	4: 1 = Security count expired
	3: 1 = Security frozen
	2: 1 = Security locked
	1: 1 = Security enabled
	0: 1 = Security supported
129-159	Vendor specific
160-254	Reserved
255	Integrity word
	15-8: Checksum
	7-0: Signature

5.6 LIMITING DATA TRANSFER SPEED TO 1.5Gb/s

Certain motherboards and controllers do not comply with the Serial ATA specification for arbitrating the data transfer rate. Maxtor DiamondMax 17 80-160GB Serial ATA hard disk drives comply with the requirements of the Serial ATA specification and can be configured to limit the maximum data transfer speed to 1.5Gb/s. Refer to chapter 3.3 for instructions on limiting the data transfer speed using a jumper setting.

Chapter 6
Service and Support

6.1 GETTING HELP

Before contacting Maxtor Support, use the Hard Disk Information feature in MaxBlast to view the model number and serial number of your drive. These numbers can be used to get help from Maxtor Support, register your drive, and look up information on the Maxtor website.

Please visit **www.maxtor.com** to obtain comprehensive support information, such as:

- Warranty Services
  - Drive returns, Warranty Status, Limited Warranty Statement
- Product Support
  - Installation Tutorials, Specifications, Jumper Settings, Installation Guides, Product Manuals
- Software Downloads
  - Installation Software, Utilities, Diagnostics
- Knowledge Base
  - Troubleshooting information, FAQs, resolved problem database
- Product Index
  - Current and Legacy Maxtor product's listing

Click on **Worldwide Support** to access the Knowledge Base, download software updates, register your drive, and get assistance via e-mail.

A

ACCESS – (v) Read, write, or update information on some storage medium, such as a disk. (n) One of these operations.

ACCESS TIME – The interval between the time a request for data is made by the system and the time the data is available from the drive. Access time includes the actual seek time, rotational latency, and command processing overhead time. See also seek, rotational latency, and overhead.

ACTUATOR – Also known as the *positioner.* The internal mechanism that moves the read/write head to the proper track. The Maxtor actuator consists of a rotary voice coil and the head mounting arms. One end of each head mounting arm attaches to the rotor with the read/write heads attached at the opposite end of each arm. As current is applied to the rotor, it rotates, positioning the heads over the desired cylinder on the media.

ALLOCATION – The process of assigning particular areas of the disk to particular files. See also allocation unit.

ALLOCATION UNIT – An allocation unit, also known as a *cluster*, is a group of sectors on the disk that can be reserved for the use of a particular file.

AVERAGE SEEK TIME – The average time it takes for the read/write head to move to a specific location. To compute the average seek time, you divide the time it takes to complete a large number of random seeks all over the disk by the number of seeks performed.

B

BACKUP – A copy of a file, directory, or volume on a separate storage device from the original, for the purpose of retrieval in case the original is accidentally erased, damaged, or destroyed.

BAD BLOCK – A block (usually the size of a sector) that cannot reliably hold data because of a media flaw or damaged format markings.

BAD TRACK TABLE – A label affixed to the casing of a hard disk drive that tells which tracks are flawed and cannot hold data. The listing is typed into the low-level formatting program when the drive is being installed. Because Maxtor disk drive's defect-management scheme handles all such flaws automatically, there is no need to concern yourself with bad track tables.

BIT – Abbreviation for binary digit. A binary digit may have one of two values—1 or 0. This contrasts with a decimal digit, which may have a value from 0 to 9. A bit is one of the logic 1or logic 0 binary settings that make up a byte of data. See also byte.

BLOCK – A sector or group of sectors.

BPI – Abbreviation for *bits per inch*. A measure of how densely information is packed on a storage medium. Flux changes per inch is also a term commonly used in describing storage density on a magnetic surface.

BUFFER – An area of RAM reserved for temporary storage of data that is waiting to be sent to a device that is not yet ready to receive it. The data is usually on its way to or from the disk drive or some other peripheral device.

BUS – The part of a chip, circuit board, or interface designed to send and receive data.

BYTE – The basic unit of computer memory, large enough to hold one character of alphanumeric data. Comprised of eight bits. See also bit.

C

CACHE – Random-access memory used as a buffer between the CPU and a hard disk. Information more likely to be read or changed is placed in the cache, where it can be accessed more quickly to speed up general data flow.

CAPACITY – The amount of information that can be stored on a disk drive. The data is stored in bytes, and capacity is usually expressed in megabytes.

CDB – Command Descriptor Block. The SCSI structure used to communicate requests from an initiator (system) to a target (drive).

CLEAN ROOM – An environmentally controlled dust-free assembly or repair facility in which hard disk drives are assembled or can be opened for internal servicing.

CLUSTER – A group of sectors on a disk drive that is addressed as one logical unit by the operating system.

CONTROLLER – Short form of *disk controller.* The chip or complete circuit that translates computer data and commands.

CONTROLLER CARD – An adapter holding the control electronics for one or more hard disks, usually installed in a slot in the computer.

CPU – Acronym for *Central Processing Unit.* The microprocessor chip that performs the bulk of data processing in a computer.

CRC – Acronym for *Cyclic Redundancy Check*. An error detection code that is recorded within each sector and is used to see whether parts of a string of data are missing or erroneous.

CYLINDER – On a disk drive that has more than one recording surface and heads that move to various tracks, the group of all tracks located at a given head position. The number of cylinders times the number of heads equals the number of tracks per drive.

D

DATA SEPARATOR – On a disk drive that stores data and timing information in an encoded form, the circuit that extracts the data from the combined data and clock signal.

DEDICATED SERVO – A surface separate from the surface used for data that contains only disk timing and positioning information and contains no data.

DEFECT MANAGEMENT – A method that is implemented to ensure long term data integrity. Defect management eliminates the need for user defect maps. This is accomplished by scanning the disk drives at the factory for defective sectors. Defective sectors are deallocated prior to shipment. In addition, during regular use, the drive continues to scan and compensate for any new defective sectors on the disk.

DISK – In general, any circular-shaped data-storage medium that stores data on the flat surface of the platter. The most common type of disk is the magnetic disk, which stores data as magnetic patterns in a metal or metal-oxide coating. Magnetic disks come in two forms: floppy and hard. Optical recording is a newer disk technology that gives higher capacity storage but at slower access times.

DISK CONTROLLER – A plug-in board, or embedded circuitry on the drive, that passes information to and from the disk. The Maxtor disk drives all have controllers embedded on the drive printed-circuit board.

DISKWARE – The program instructions and data stored on the disk for use by a processor.

DMA – Acronym for *direct memory access*. A process by which data moves directly between a disk drive (or other device) and system memory without passing through the CPU, thus allowing the system to continue processing other tasks while the new data is being retrieved.

DRIVE – Short form of *disk drive*.

DRIVE GEOMETRY – The functional dimensions of a drive in terms of the number of heads, cylinders, and sectors per track. See also logical format.

E

ECC – Acronym for *error correction code*. The recording of extra verifying information encoded along with the disk data. The controller uses the extra information to check for data errors, and corrects the errors when possible.

EMBEDDED SERVO – A timing or location signal placed on the disk's surface on the tracks that also store data. These signals allow the actuator to fine-tune the position of the read/write heads.

ENCODING – The protocol by which particular data patterns are changed prior to being written on the disk surface as a pattern of On and Off or 1 and 0 signals.

EXTERNAL DRIVE – A drive mounted in an enclosure separate from the PC or computer system enclosure, with its own power supply and fan, and connected to the system by a cable.

F

FAT – Acronym for *file allocation table*. A data table stored on the outer edge of a disk that tells the operating system which sectors are allocated to each file and in what order.

FCI – Acronym for *flux changes per inch*. See also BPI.

FILE SERVER – A computer that provides network stations with controlled access to shareable resources. The network operating system is loaded on the file server, and most shareable devices (disk subsystems, printers) are attached to it. The file server controls system security and monitors station-to-station communications. A dedicated file server can be used only as a file server while it is on the network. A non dedicated file server can be used simultaneously as a file server and a workstation.

FLUX DENSITY – The number of magnetic field patterns that can be stored in a given length of disk surface. The number is usually stated as flux changes per inch (FCI), with typical values in the thousands.

FLYING HEIGHT – The distance between the read/write head and the disk surface caused by a cushion of air that keeps the head from contacting the media. Smaller flying heights permit more dense storage of data, but require more precise mechanical designs.

FORMAT – To write onto the disk surface a magnetic track pattern that specifies the locations of the tracks and sectors. This information must exist on a disk before it can store any user data. Formatting erases any previously stored data.

FORMATTED CAPACITY – The amount of room left to store data on the disk after the required space has been used to write sector headers, boundary definitions, and timing information generated by a format operation. All Maxtor drive capacities are expressed in formatted capacity.

FORM FACTOR – The physical outer dimensions of a device as defined by industry standard. For example, most Maxtor disk drives use a 3 1/2-inch form factor.

G

GIGABYTE (GB) – One billion bytes (one thousand megabytes).

GUIDE RAILS – Plastic strips attached to the sides of a disk drive mounted in an IBM AT and compatible computers so that the drive easily slides into place.

H

HALF HEIGHT – Term used to describe a drive that occupies half the vertical space of the original full size 5 1/4-inch drive. 1.625 inches high.

HARD DISK – A type of storage medium that retains data as magnetic patterns on a rigid disk, usually made of an iron oxide or alloy over a magnesium or aluminum platter. Because hard disks spin more rapidly than floppy disks, and the head flies closer to the disk, hard disks can transfer data faster and store more in the same volume.

HARD ERROR – A repeatable error in disk data that persists when the disk is reread, usually caused by defects in the media surface.

HEAD – The tiny electromagnetic coil and metal pole piece used to create and read back the magnetic patterns (write and read information) on the media.

HIGH-CAPACITY DRIVE – By industry conventions typically a drive of 1 gigabytes or more.

HIGH-LEVEL FORMATTING – Formatting performed by the operating system's format program. Among other things, the formatting program creates the root directory and file allocation tables. See also low-level formatting.

HOME – Reference position track for re-calibration of the actuator, usually the outer track (track 0).

HOST ADAPTER – A plug-in board that forms the interface between a particular type of computer system bus and the disk drive.

I

INITIALIZE – See low level formatting.

INITIATOR – A SCSI device that requests another SCSI device to perform an operation. A common example of this is a system requesting data from a drive. The system is the initiator and the drive is the target.

INTERFACE – A hardware or software protocol, contained in the electronics of the disk controller and disk drive, that manages the exchange of data between the drive and computer.

INTERLEAVE – The arrangement of sectors on a track. A 1:1 interleave arranges the sectors so that the next sector arrives at the read/write heads just as the computer is ready to access it. See also interleave factor.

INTERLEAVE FACTOR – The number of sectors that pass beneath the read/write heads before the next numbered sector arrives. When the interleave factor is 3:1, a sector is read, two pass by, and then the next is read. It would take three revolutions of the disk to access a full track of data. Maxtor drives have an interleave of 1:1, so a full track of data can be accessed within one revolution of the disk, thus offering the highest data throughput possible.

INTERNAL DRIVE – A drive mounted inside one of a computer's drive bays (or a hard disk on a card, which is installed in one of the computer's slots).

K

KILOBYTE (Kb) – A unit of measure consisting of 1,024 (2^{10}) bytes.

L

LANDING ZONE – A position inside the disk's inner cylinder in a non data area reserved as a place to rest the heads during the time that power is off. Using this area prevents the heads from touching the surface in data areas upon power down, adding to the data integrity and reliability of the disk drive.

LATENCY – The period of time during which the read/write heads are waiting for the data to rotate into position so that it can be accessed. Based on a disk rotation speed of 3,662 rpm, the maximum latency time is 16.4 milliseconds, and the average latency time is 8.2 milliseconds.

LOGICAL FORMAT – The logical drive geometry that appears to an AT system BIOS as defined by the drive tables and stored in CMOS. With an installation program like Disk Manager, the drive can be redefined to any logical parameters necessary to adapt to the system drive tables.

LOOK AHEAD – The technique of buffering data into cache RAM by reading subsequent blocks in advance to anticipate the next request for data. The look ahead technique speeds up disk access of sequential blocks of data.

LOW-LEVEL FORMATTING – Formatting that creates the sectors on the platter surfaces so the operating system can access the required areas for generating the file structure. Maxtor drives are shipped with the low-level formatting already done.

LOW PROFILE – Describes drives built to the 3 1/2-inch form factor, which are only 1 inch high.

M

MB – See megabyte.

MEDIA – The magnetic film that is deposited or coated on an aluminum substrate which is very flat and in the shape of a disk. The media is overcoated with a lubricant to prevent damage to the heads or media during head take off and landing. The media is where the data is stored inside the disk in the form of magnetic flux or polarity changes.

MEGABYTE (Mb) – A unit of measurement equal to 1,024 kilobytes, or 1,048,576 bytes except when referring to disk storage capacity.

1 MB = 1,000,000 bytes when referring to disk storage capacity. See also kilobyte.

MEGAHERTZ – A measurement of frequency in millions of cycles per second.

MHz – See megahertz.

MICROPROCESSOR – The integrated circuit chip that performs the bulk of data processing and controls the operation of all of the parts of the system. A disk drive also contains a microprocessor to handle all of the internal functions of the drive and to support the embedded controller.

MICROSECOND (µs) – One millionth of a second (.000001 sec.).

MILLISECOND (ms) – One thousandth of a second (.001 sec.).

MTTF – MTTF is a basic measure of reliability for non-repairable systems. It is the mean time expected until the first failure of a piece of equipment. MTTF is a statistical value and is meant to be the mean over a long period of time and large number of units. For constant failure rate systems, MTTF is the inverse of the failure rate. If failure rate is in failures/million hours, MTTF = 1,000,200 / Failure Rate for components with exponential distributions.

MTTR – Mean Time To Repair. The average time it takes to repair a drive that has failed for some reason. This only takes into consideration the changing of the major sub-assemblies such as circuit board or sealed housing. Component level repair is not included in this number as this type of repair is not performed in the field.

O

OVERHEAD – The processing time of a command by the controller, host adapter or drive prior to any actual disk accesses taking place.

OVERWRITE – To write data on top of existing data, erasing it.

OXIDE – A metal-oxygen compound. Most magnetic coatings are combinations of iron or other metal oxides, and the term has become a general one for the magnetic coating on tape or disk.

P

PARTITION – A portion of a hard disk devoted to a particular operating system and accessed as one logical volume by the system.

PERFORMANCE – A measure of the speed of the drive during normal operation. Factors affecting performance are seek times, transfer rate and command overhead.

PERIPHERAL – A device added to a system as an enhancement to the basic CPU, such as a disk drive, tape drive or printer.

PHYSICAL FORMAT – The actual physical layout of cylinders, tracks, and sectors on a disk drive.

PLATED MEDIA – Disks that are covered with a hard metal alloy instead of an iron-oxide compound. Plated disks can store greater amounts of data in the same area as a coated disk.

PLATTER – An disk made of metal (or other rigid material) that is mounted inside a fixed disk drive. Most drives use more than one platter mounted on a single spindle (shaft) to provide more data storage surfaces in a small package. The platter is coated with a magnetic material that is used to store data as transitions of magnetic polarity.

POH – Acronym for *power on hours*. The unit of measurement for Mean Time Between Failure as expressed in the number of hours that power is applied to the device regardless of the amount of actual data transfer usage. See MTBF.

POSITIONER – See actuator.

R

RAM – Acronym for *random access memory*. An integrated circuit memory chip which allows information to be stored and retrieved by a microprocessor or controller. The information may be stored and retrieved in any order desired, and the address of one storage location is as readily accessible as any other.

RAM DISK – A "phantom disk drive" for which a section of system memory (RAM) is set aside to hold data, just as if it were a number of disk sectors. The access to this data is extremely fast but is lost when the system is reset or turned off.

READ AFTER WRITE – A mode of operation that has the computer read back each sector on the disk, checking that the data read back is the same as recorded. This slows disk operations, but raises reliability.

READ VERIFY – A disk mode where the disk reads in data to the controller, but the controller only checks for errors and does not pass the data on to the system.

READ/WRITE HEAD – The tiny electromagnetic coil and metal pole piece used to create and read back the magnetic patterns (write or read information) on the disk. Each side of each platter has its own read/write head.

REMOVABLE DISK – Generally said of disk drives where the disk itself is meant to be removed, and in particular of hard disks using disks mounted in cartridges. Their advantage is that multiple disks can be used to increase the amount of stored material, and that once removed, the disk can be stored away to prevent unauthorized use.

RLL – Run Length Limited. A method used on some hard disks to encode data into magnetic pulses. RLL requires more processing, but stores almost 50% more data per disk than the MFM method.

ROM – Acronym for *read only memory*. Usually in the form of an ROM in the controller that contains programs that can be accessed and read but not modified by the system.

ROTARY ACTUATOR – The rotary actuator replaces the stepper motor used in the past by many hard disk manufacturers. The rotary actuator is perfectly balanced and rotates around a single pivot point. It allows closed-loop feedback positioning of the heads, which is more accurate than stepper motors.

ROTATIONAL LATENCY – The delay between when the controller starts looking for a specific block of data on a track and when that block rotates around to where it can be read by the read/write head. On the average, it is half of the time needed for a full rotation (about 8 ms.).

S

SATA - Acronym for Serial ATA.

SCSI – Acronym for *Small Computer System Interface*, an American National Standards Institute (ANSI) version of Shugart Associates' SASI interface between the computer and controller. SCSI has grown in popularity and is one of the most flexible and intelligent interfaces available.

SECTOR – A section of space along a track on the disk, or the data that is stored in that section. Hard disks most often have sectors that are 512 data bytes long plus several bytes overhead for error correcting codes. Each sector is preceded by ID data known as a header, which cannot be overwritten.

SEEK – A movement of the disk read/write head in or out to a specific track.

SERVO DATA – Magnetic markings written on the media that guide the read/write heads to the proper position.

SERVO SURFACE – A separate surface containing only positioning and disk timing information but no data.

SETTLE TIME – The interval between when a track to track movement of the head stops, and when the residual vibration and movement dies down to a level sufficient for reliable reading or writing.

SHOCK RATING – A rating (expressed in Gs) of how much shock a disk drive can sustain without damage.

SOFT ERROR – An error in reading data from the disk that does not recur if the same data is reread. Often caused by power fluctuations or noise spikes.

SOFT SECTORED – Disks that mark the beginning of each sector of data within a track by a magnetic pattern.

SPINDLE – The center shaft of the disk upon which the drive's platters are mounted.

SPUTTER – A type of coating process used to apply the magnetic coating to some high-performance disks. In sputtering, the disks are placed in a vacuum chamber and the coating is vaporized and deposited on the disks. The resulting surface is hard, smooth, and capable of storing data at high density. Maxtor disk drives use sputtered thin film disks.

STEPPER – A type of motor that moves in discrete amounts for each input electrical pulse. Stepper motors used to be widely used for read/write head positioner, since they can be geared to move the head one track per step. Stepper motors are not as fast or reliable as the rotary voice coil actuators which Maxtor disk drives use.

SUBSTRATE – The material the disk platter is made of beneath the magnetic coating. Hard disks are generally made of aluminum or magnesium alloy (or glass, for optical disks) while the substrate of floppies is usually mylar.

SURFACE – The top or bottom side of the platter which is coated with the magnetic material for recording data. On some drives one surface may be reserved for positioning information.

T

THIN FILM – A type of coating, used for disk surfaces. Thin film surfaces allow more bits to be stored per disk.

TPI – Acronym for *tracks per inch*. The number of tracks or cylinders that are written in each inch of travel across the surface of a disk.

TRACK – One of the many concentric magnetic circle patterns written on a disk surface as a guide to where to store and read the data.

TRACK DENSITY – How closely the tracks are packed on a disk surface. The number is specified as tracks per inch (TPI).

TRACK TO TRACK SEEK TIME – The time required for the read/write heads to move to an adjacent track.

TRANSFER RATE – The rate at which the disk sends and receives data from the controller. Drive specifications usually reference a high number that is the burst mode rate for transferring data across the interface from the disk buffer to system RAM. Sustained data transfer is at a much lower rate because of system processing overhead, head switches, and seeks.

U

UNFORMATTED CAPACITY – The total number of bytes of data that could be fit onto a disk. Formatting the disk requires some of this space to record location, boundary definitions, and timing information. After formatting, user data can be stored on the remaining disk space, known as formatted capacity. The size of a Maxtor drive is expressed in formatted capacity.

V

VOICE COIL – A type of motor used to move the disk read/write head in and out to the right track. Voice-coil actuators work like loudspeakers with the force of a magnetic coil causing a proportionate movement of the head. Maxtor's actuator uses voice-coil technology, and thereby eliminates the high stress wearing parts found on stepper motor type actuators.

W

WEDGE SERVO – The position on every track that contains data used by the closed loop positioning control. This information is used to fine tune the position of the read/write heads exactly over the track center.

WINCHESTER DISKS – Hard disks that use a technology similar to an IBM model using Winchester as the code name. These disks use read/write heads that ride just above the magnetic surface, held up by the air flow created by the turning disk. When the disk stops turning, the heads land on the surface, which has a specially lubricated coating. Winchester disks must be sealed and have a filtration system since ordinary dust particles are large enough to catch between the head and the disk.

WRITE ONCE – In the context of optical disks, technologies that allow the drive to store data on a disk and read it back, but not to erase it.